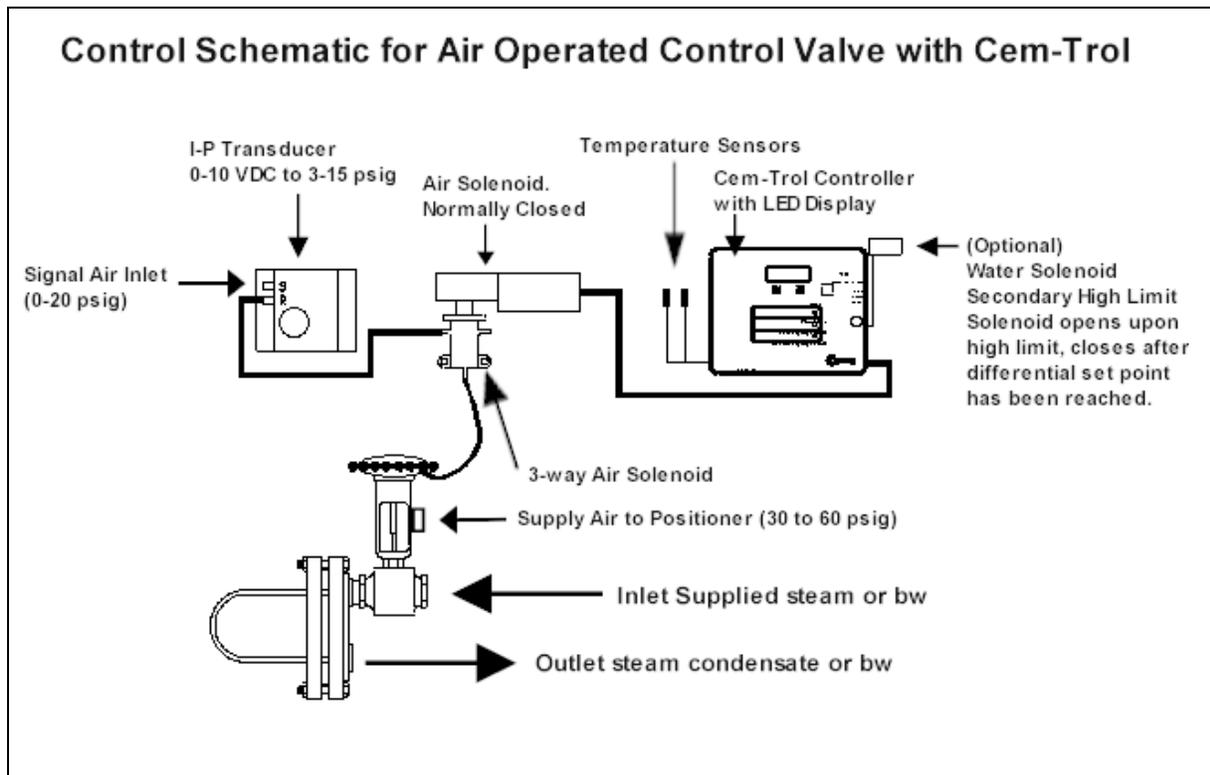


TECHNICAL PAPER: Proper operation of a Cemline Water Heater supplied with a pneumatically operated temperature control valve, a Cem-trol® controller, and an I-P transducer.

The operation of the Cem-trol operating and high limit controller, a I-P transducer, and a pneumatic control valve works as follows on a steam-to-water or water-to-water water heater. Two temperature sensors are submerged in the heated water and connected to the Cem-trol. One sensor is used for the operating temperature of the water heater, while the second temperature sensor is used for the high limit controls. The Cem-trol controller measures the resistance of the temperature sensors and based upon the water temperature the Cem-trol sends a variable 0-10 VDC signal to the I-P transducer. The I-P transducer converts an electronic control 0 –10 Volt DC signal to a pneumatic signal. The pneumatic air signal is sent to the control

valve to modulate the valve. When there is a demand for hot water the controller will send an increased VDC output signal to the I-P transducer, thereby opening the control valve allowing more steam or boiler water to pass through the control valve and heat the water. As the temperature in the water heater is satisfied and it arrives at the desired set point the Cem-trol will decrease the VDC output signal going to the I-P transducer. The lower VDC signal will decrease the signal air being sent to the control valve allowing less steam or boiler water to pass through the control valve. When the voltage output signal is 0 VDC the control valve will be closed. Cemline furnishes a 3-way air solenoid piped in the airline in between the I-P transducer and the control valve. The air solenoid shuts off the signal air to the control valve in the event the temperature in the tank rises above the primary high limit temperature set point of the Cem-trol and/or there is no power to the unit. In most cases, the pneumatic



control valve will be supplied with a valve positioner. The positioner increases the control valve's response time along with improving the repeatability of the stem position allowing for improved performance of valve and the water heater. The positioner will have two inputs. The first is the signal air, which comes from the I-P transducer and the second is a supply air signal of 20 to 60 psig depending upon the valve type and positioner model. Please verify if the valve has a positioner and the positioner is being provided the recommended supply air signal. Cemline recommends the signal air and the supply air each have their own air pressure regulators installed in the field before being piped to the Cemline water heater.

For basic instructions on how to set the operating temperature and high limit(s) set points on Cem-trol please see the Cem-trol Installation, Operation and Maintenance Manual.

The importance of the proper signal air pressure supplied to the I-P transducer.

The Cem-trol controls the temperature in the water heater by sending a proportional 0 –10 VDC signal to the I-P transducer. The I-P transducer converts the 0-10 VDC to a 3 –15 or 0-20 psig air signal (depending upon the model of I-P transducer supplied). One common oversight is to provide 30 psig or greater signal air to the I-P transducer. Most control valves will stroke with 3 – 15 or a 5 – 12 psig air signal. The control valve will be wide open when the signal pressure is 15-psig and closed when the signal air is less than 3 psig. The I-P transducer reduces the signal air pressure to the valve by a minimum of 5 psig from the input signal. When supplied with 30 psig or greater the maximum output pressure of the I-P would be 25 psig, opening the valve fully. This higher

output pressure will cause the valve to quickly stroke wide open followed by a rapid shut off. When the valve is wide open a large amount of steam or boiler water enters the tube bundle causing the temperature to rise in the unit above the set point. Then the valve closes because the set point has been met. As water flows through the unit with a closed valve, the temperature in the unit decreases. The rapid opening and closing of the valve is called valve hunting, which causes temperature swings in the heater.

One method of reducing hunting of the valve is to reduce the signal air pressure going to the I-P transducer. The I-P transducer sends the signal air to the control valve providing energy to stroke the valve open/closed. The I-P transducer usually accepts a 0 – 30 psig input air signal and then sends out between 0 – 25 psig to the valve based upon the temperature setting of the Cem-trol. The amount of signal air pressure sent out to the valve is dependent upon the relationship between the water temperature, the set point of the Cem-trol, and how much signal air pressure is being supplied to the I-P transducer.

Therefore, Cemline recommends that initial signal air to the I-P transducer to be set between 15 –18 psig. If the unit is being used for lower loads than the water heater's original design the air signal may have to be reduced to between 5 – 12 psig.

On units supplied with a valve positioner, if the signal air has been reduced and the valve is still stroking too quickly, the supply pressure may need to be regulated lower as well. The positioner's supply pressure recommended to stroke the valve may be between 20 – 60 psig depending upon the make and model of the positioner. When reducing the supply pressure to the positioner reduce the pressure in increments of 5 psig.



How to properly set and adjust the signal air to the I-P transducer to reduce temperature fluctuations in the water heater.

Set the Cem-trol to the desired set point. Check the digital readout temperature on the Cem-trol to see the temperature of the water in the heater.

If the temperature is fluctuating on the high side of the set point reduce the signal air pressure going to the I-P transducer. Start by reducing the air pressure to 18 psig. Continue to reduce the signal air pressure to the I-P transducer until the unit achieves a required set point. The signal air may need to be reduced to as low as 5 psig depending upon the system conditions.

How to properly set the high limit on the Cem-trol.

The limit control is set on the Cem-trol controller. (See the IOM manual for the setting the high limit temperature controller). For proper operation, the desired operating temperature and the primary high limit or high limit cut out temperature should be set 10 °F above the operating temperature. If the unit was supplied with an optional secondary water solenoid the secondary high limit is normally set 20 °F higher than the operating temperature. For example if the heater is to be operated at 140 °F the operating temperature should be set at 140 °F, the high limit temperature should be set at 150 °F, and the secondary high limit should be set at 160 °F. This will allow for normal operation of the water heater.